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ABSTRACT

The use of virtual reality technology in the Communication discipline is a challenge that educators in the field should investigate thoroughly and begin to embrace as they move into the 21st century. Classrooms with access to the Internet allow students to move outside the physical boundaries of the classroom and suggest a significant change in how classrooms will be designed and used in the future. Three specific directions that classrooms and teaching might move as technology asserts itself more and more into education are: (1) a permutation of the current historical model of classrooms and teaching; (2) distance education; and (3) self-directed learning using virtual reality. Serious attention has been brought to using virtual reality as a teaching tool in formal educational settings only in the 1990s. Virtual reality is currently being used and explored in educational settings. The next 10 years should see continued activity and the creation of more alliances to design and develop virtual reality programs for use in education. The future of virtual reality in education might include Individual Virtual Environment Pods in which students interact physically and vocally with people and experiences based on specific pedagogic goals. Teachers in such a future would create electronic and computerized modules and act as consultants, assisting students on an individual basis. Contains 12 references. (RS)

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2010 AND BEYOND: VIRTUAL REALITY AND THE COMMUNICATION CLASSROOM

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Introduction

Classrooms have not changed much over the centuries. Walking into a classroom in the 1990's hasn't really proved to be much different than walking into a classroom in the 1690's. Of course, decorations, general appearance and architecture have evolved and changed over the centuries with the whims and desires of designers, society, teachers, and students, but the basic components of classrooms have remained fairly static over the centuries, since even Plato and Socrates taught. Generally speaking, classrooms have traditionally consisted of a room, usually square, with some kind of seats and desks for students, a desk and chair for the teacher, a lectern of some sort, and eventually the ubiquitous blackboard and chalk.

Since the 1950's classrooms have seen some other additions related to technology and the delivery of information. These additions include devices such as film, opaque, slide, overhead and video projectors, televisions and video players and recorders, and in the last decade, hardware and software to facilitate computer presentation materials. The blackboard and chalk have been replaced in some instances by whiteboards and erasable markers, but, for the most part, these changes are superficial, and do not mark a significant departure from the traditional look and function of contemporary classrooms, and from traditional classroom pedagogy.

There have been two significant innovations in the appearance and function of classrooms in the past decade. These innovations are the advent of classroom computer labs and distance education classrooms. Even though, in the case of classroom computer labs, the basic classroom features previously described remain, such as desks, chairs, lecterns, black or white boards, and different kinds of projectors, we see an addition to these types of classrooms that provide instructors with new pedagogical approaches to their subjects, and that suggest for the first time

in centuries that a revolution in classroom appearance and design may be upon us. That addition to the classroom is the computer and access to the World Wide Web through the Internet.

Classroom computer labs, and even classrooms with a single computer with access to the Internet allow classes to move outside the physical boundaries of the classroom. They allow students to immediately access people, and information, literally all over the globe. This is a significant change from the traditional classroom, and suggests a significant change in how classrooms will be designed and used in the future.

In the case of distance education classrooms, we frequently see the addition of computers and access to the Internet, and the benefits and changes mentioned in the last paragraph, but we also see video and audio technology in these classrooms that allow a teacher in one location to conduct classes literally all over the world. Again, this marks a significant change from the traditional classroom, and suggests another significant change in how classrooms will be designed and used in the future.

As we enter a new millennium, we are beginning to see opportunities emerge that allow us to reconsider the environments in which learning takes place, and the methods that we use to teach our students. Traditionally, students have gathered at elementary, junior and senior high schools, and at community colleges and four year colleges and universities, where they have been divided into groups based on differing demographics and needs. They have then gathered in classrooms, in which an instructor is responsible for guiding the students through the process of learning.

However, for the first time in centuries, modern technology is providing us with opportunities to break these molds, and to redefine where we teach our students, and how we teach them. The classroom computer lab and the distance education classroom are just the beginning of this process. As technology continues to evolve and improve, the possibilities for creating new learning environments and styles of teaching are virtually limitless. And, I use the word "virtually" very purposefully, because a specific type of technology that may have the greatest impact on teaching and learning is the prospect of virtual reality technology.

Statement of Purpose

The purposes of this paper are: (1) to suggest some directions that education and pedagogy might move in the future in response to modern technology, and (2) to specifically propose and define how classrooms in the future might look and be used based on virtual reality technology.

These two purposes are predicated on five general questions that this issue raises. Perhaps this essay will begin to provide some answers to these questions, or it may just create more questions:

1. How will the classroom environment change as a result of technology?
2. How will the process of teaching change as a result of technology?
3. How will the process of learning change as a result of technology?
4. What will the impact of these changes be on students?
5. What will the impact of these changes be on teachers?

Specific Models of Classrooms and Teaching

There are many different directions that classrooms and styles of teaching might move during the 21st Century. This essay proposes three specific directions that

classrooms and teaching might move as technology asserts itself more and more into education:

The first model is actually no more than a permutation of the current historical model of classrooms and teaching. In this model, students still physically assemble in "classes" in a specific location on a campus, and an instructor plans and directly leads the class though the learning process. Forms of technology will likely be used to varying degrees in these environments, and some classrooms will be more technologically sophisticated than others. For instance, the Classroom Technologies Committee at Indiana University, Bloomington (1997) has defined four categories of classrooms for use on their campus, based on technology capability, and suggesting directions in which pedagogy and learning might move in such environments. The four categories are:

Type I (Basic): General purpose classrooms that have no technology permanently installed, but have an environment conducive to the use of mobile technology.

Type II (Basic Plus): General purpose classrooms of small to medium size that have basic video playback installed, and have an environment conducive to the use of mobile technology.

Type III (Mid-range Technology Classroom [MTC]): General purpose classrooms with installed video/data projector(s), VCR, external computer/video/audio inputs, keypad system controller.

Type IV (Advanced Technology Auditorium [ATA]): General purpose classrooms with installed video/data projector(s), analog and digital storage devices, auxiliary computer/video/audio inputs, touch screen system controller.

The use of this model, and these types of classrooms, in the future is predicated on the continued use of the "campus" model of teaching and learning. But, I personally am

not convinced that we can rely on that model remaining viable in the future. Certainly technology will open doors that will allow us to reconfigure, and even reinvent, how we teach and learn, but more importantly than that, economic factors may eventually make the campus model of education obsolete. It may become too expensive to build and maintain campi, and it may become too expensive for students to matriculate on campi. These factors alone may force educators and administrators to find new ways to teach that make use of new technologies as they become available, and that are economically feasible. This leads us to consider the second model of teaching and learning.

The second model is based on the distance education model of classrooms and teaching. There are two different ways that this model can be used to create an educational environment. In one, students stay at home, and watch videotaped or live class sessions on television that are prepared by an educational facility, and broadcast for television reception. The other way that distance education can be offered to students is through the previously mentioned distance education classrooms. In these situations, students gather at locations that feature specifically designed distance education classrooms. There is an origination site, from which an instructor conducts a class, and there are satellite sites, where other students gather, and the instructor plans, guides and leads the learning process, broadcasting to the satellite sites using video and audio technology.

The first type of distance education model has the potential to significantly ease the financial burden on education that seems to be increasing geometrically. Rather than maintaining a complete campus that fulfills the needs of academic disciplines involved, there would only be a need for facilities to produce the materials that would be broadcast to students. Overhead expenses could potentially be drastically reduced.

The second type described may or may not be financially feasible in the future. Academic institutions would need to build and maintain the origination sites and the satellite sites, as well as provide facilities for instructional staff, and on-campus students. Overhead would likely be similar to the current campus model of education. This leads us to consider the third model of teaching and learning.

The third model of classrooms and teaching is the self-directed model. In this model, students either remain at home, or they gather at a specific site, which might be a campus, or it might be a mall, church or community center. However, they participate in self-directed learning activities that have been designed by professional educators, and that are delivered through interactive computer-based environments. The students move through these activities at their own pace. This model proposes to be the most revolutionary, and the most threatening to education as we think of it historically. This model proposes that students can learn on their own, and breaks the mold of historical, conventional student-teacher interaction. It is far removed from the "school house" concept that we are used to. It is on this model of classrooms and teaching, and on possible applications of virtual reality, that the remainder of this essay will focus.

The World of Virtual Reality

When someone mentions the words "Virtual Reality" we often think of artificial environments that we have seen created on television programs, in films or in fiction such as that written by William Gibson, the creator of the word "Cyberspace." Star Trek: The Next Generation fans will likely think of the holodeck on the Starship Enterprise, someone else might think of the film Lawnmower Man, or fans of the new Johnny Quest cartoon show will think of the virtual environments depicted in

that program. These are all possible examples of where virtual technology might lead us, but they also are all predicated on significant technological advances and sophisticated and expensive hardware and software.

The recent Tom Clancy television movie Netforce depicted a common interpretation of how virtual reality might work. To access virtual reality environments people wore headsets that covered their eyes with visual display goggles, and that contained microphones and ear pieces that allowed them to "communicate" with a computer that created the virtual reality environment. They also wore gloves that translated their movements into signals that the computer could interpret. The computer then generated an imaginary world that the person could enter and interact within through the goggles, microphone and earphones. My guess is that eventually the virtual worlds that we see created in film, television and literature will eventually come to fruition, and will eventually have an impact on education, but there are other modes of virtual reality that we are closer to using on a regular basis in teaching and learning.

At this point, it would be useful to summarize briefly the history of virtual reality, and to consider a definition of virtual reality. Virtual reality has been around since the 1920's, when the Link Corporation created the first simulated flight training devices for pilots (Sanders, 1998). However, virtual reality began to really blossom in the 1970's and 80's as advances in computer technology were made. In the early 1970's Myron Krueger coined the term "artificial reality" and in the 1980's Jaron Lanier coined the term "virtual reality." The 80's saw the move from flight trainer sorts of applications in which a person watched and interacted with an image on a screen to the use of goggles and gloves to allow people to more directly interact with

the imaginary environments. (Brief histories of virtual reality can be found in: Littman, 1996; Pantelidis, 1995 and 1993.)

According to Sanders, "there is no generally agreed upon definition of virtual reality," and there are now many different types of virtual reality that are being developed and experimented with: artificial reality; augmented reality; immersive reality; and telepresence, to name but a few. All of these different types of virtual reality provide different experiences in relation to immersion, interactivity, and unencumbered navigation (Krueger, 1993 and Pantelidis, 1993). This essay uses the definition of virtual reality offered by Sanders: "an interactive, self-directed, multisensory, computer-generated experience providing an illusion of participating in a synthetic three-dimensional (3-D) environment.

Virtual reality technology currently exists at a simpler level than many of the examples described previously in this essay, and as demonstrated in film, television, and literature, and it can be found currently in use on the world wide web, and even in some classrooms. To experience a virtual environment, we do not necessarily have to be outfitted in data-gathering and exchanging suits and headsets. Virtual environments can be created with current hardware and software, and experienced visually through personal computers and other distribution tools. For instance, if you visit the web site of the Chicago Bears National Football League Team offered through the Chicago Tribune (www.chicagotribune.com/sports/bears/), you can take a "virtual tour" of Soldier Field, the home field of the Bears. Many web sites offer these "virtual experiences."

But, virtual reality has also begun to find use in educational contexts. For instance, Learning Sites, Inc. has created a computer program that creates a "virtual tour" of

archeological excavations and digs for students. The program recreates visually what ancient sites looked like, and shows people in ancient civilizations performing daily tasks. The student is not able to physically interact with the recreated environment as depicted in films and television shows, but the student is able to observe two dimensional and even three dimensional reproductions of these environments. It is this type of educational application of virtual reality that this essay will now explore.

The Use of Virtual Reality in Educational Contexts

Sanders notes that virtual reality has not had a long history in educational contexts (See the notation for the Human Interface Technology Laboratory, 1999 in the references for this essay for an extensive on-line bibliography of resources on virtual reality and education). It has only been in probably the last ten years that any serious attention has been brought to using virtual reality as a teaching tool in formal educational settings. That trend will likely increase in the future as obstacles to using virtual reality in education are overcome.

As virtual reality is introduced in educational settings there are many issues that must be addressed and problems to be resolved. Two major issues are: finances and training. First, there is always the problem of money. Virtual reality technology is expensive to develop, and is still relatively young in its development, when costs are usually the highest. Bringing virtual reality programs to schools will be an expensive proposition. Second, there is the problem of training teachers to use virtual reality. Teachers must not only learn to use the hardware and software, but they must also learn to create pedagogically sound contexts within which to use the technology. There are many other obstacles that will be encountered as virtual reality becomes a regular part of educational settings, but at this point, I prefer to focus on the possibilities of virtual reality in education.

Virtual Reality and Education Now and in the Next Ten Years

Virtual reality is currently being used and explored in educational settings. Sanders notes that one of the first experiments in using virtual reality as a teaching aid took place in the early nineties at New Castle-upon-Tyne, England, at the West Denton High School (Clark, 1992). They designed three virtual environments that were used on laptop computers. One environment was a dangerous factory setting to teach health and safety issues; a second was a foreign city that students had to navigate; and the third was an outdoor sculpture park used to explore alternative uses of public lands. In the mid-nineties the Human Interface Technology Lab at the University of Washington created a virtual re[illegible] roving vehicle program that was used by over 3,000 grade school students. The goals of the program were to demystify virtual reality; give students and teachers opportunities to explore the possibilities of using virtual reality as a learning tool; and to see if students really would respond positively to educational opportunities with virtual reality (Winn, 1995).

Syracuse University, in the mid 1990's, created a learning environment that it calls The Living Textbook (Mills, 1995). The Living Textbook is described as "a unique learning environment enabling teachers and students to use educational resources on multimedia information servers, supercomputer, parallel databases and network testbeds." Students and teachers have access to information and databanks, as well as specific educational programs that have been created for this project or for other projects. For instance, one program called The Interactive Journey features a real-time simulated flight over New York State that allows students to visit different regions of the state and visit through virtual tours significant sites and landmarks such as Niagra Falls and the Empire State Building. The system is also networked with other information resources such as KidsWeb and NYNET.

The Virtual Reality and Education Laboratory at East Carolina University was created to design and develop virtual reality educational programs, and to train teachers on how to use such programs, addressing one of the previously mentioned problems with using virtual reality as a teaching aid. The lab has created virtual reality programs for North Carolina public schools on topics such as: history; alphabet recognition for learning disabled children; atomic modeling; electromagnetic spectrum studies and literature. Sanders cites that many more archaeological virtual reality computer programs exist besides the one created by The Learning Sites, Inc. Sanders notes that virtual reality programs have been created that allow students to explore the Fortress of Buhen (Bill Riseman), the Egyptian Tombs at Saqqara and the Fayum (University of Pisa), the caves at Lascaux (University of Cincinnati), the Giza Plateau (University of Chicago), the tomb of Nefertari (Italian Power and Light Company), the theatre complex of Pompeii (SIMLAB at Carnegie Mellon).

The Human Interface Technology Lab at the University of Washington currently offers a guide to developing virtual environments that is specifically designed to assist teachers who are working with the HITL, but that provides valuable information for those interested in investigating the use of such technology independently (Osberg, 1999). A Teachers Guide to Developing Virtual Environments: VRRV Project Support is a twenty-eight page document available over the internet, that outlines proceedures for creating virtual environments for use in teaching, based upon a four step process: planning, building, programming and experiencing. The document demonstrates how complex this process can be, and how important the proper technical support is in creating and using virtual environments in educational settings.

The next ten years should see continued activity, and the creation of more alliances to design and develop virtual reality programs for use in education, and to train teachers on the use of these programs. As the technology advances, we will likely see the use of more technologically sophisticated virtual reality programs, perhaps even moving from the current standards of virtual tours into the realm of what is now considered science fiction: holodecks and headgear and suits that allow students to literally experience and act within a virtual environment.

Virtual Reality and Education Beyond 2010

At this point in this essay, I am going to diverge from the standard academic format of providing well-supported, logical, provable assertions, and indulge my imagination. I wish to share with you a scenario that I think would be interesting to see evolve in the coming millennium. This is an entirely speculative hypothesis that might be better suited to a William Gibson novel, but that provides a situation and a context for education that I think would be very exciting, and that I would love to teach in.

The year is 2054. In August I turn 100 years old. The average age expectancy is now 150 years. There is a possibility that I may live to see the third millennium. Fortunately, there will be no Y3K problems. (Things were pretty chaotic from 2000 to 2015, but no Postman type scenarios.) My heart has been replaced with an organically grown clone (In the past two years I really have suffered two heart attacks). I no longer suffer from diabetes or hypertension. Drug therapies have been discovered that allow the cardiovascular, digestive and endocrine systems to properly regulate blood pressure, blood sugar and to convert food to energy. Part of my body is cybernetic, replacing joints that became arthritic. My Penfield Mood Organ (Thank

you, Philip K. Dick: from his novel, Do Androids Dream of Electric Sheep.) takes care of any problems with depression, chronic or situational.

I still teach in a Communication Studies Department, but it is located within Universal University. Universal University's main campus is on planet Earth, and it has regional campus' on the Earth's moon, and the colonized planets Mars and Venus. Students do not attend classes on these campi. Rather, educational materials are constructed on these campi, and broadcast or otherwise distributed to students through the Universe Wide Web or other outlets.

There are no classes conducted as we currently define them. Teachers now have two primary responsibilities in their jobs: 1) they create electronic and computerized modules that teach students course materials and concepts, and that are broadcast or otherwise distributed to students; and 2) they act as consultants, assisting students with specific questions and concerns on an individual basis. In this new academic environment, students now learn through self-directed programs of study.

Each student now owns an Individual Virtual Environment Learning Pod (IVELP). Each IVELP is similar in structure to a sensory deprivation chamber, and is about the same size as a porta-potty, maybe a little bigger. The pod has a door, but no windows. Inside there are computer controls, data input ports, etc. and a seat. The student can use the seat, or can stand through a session, depending on the program to be used. There is a headset inside each unit that contains visual display goggles, a microphone and earphones. There is no need to wear a suit or gloves to transfer body movement data to the onboard computer because there is a matrix of laser beams that criss-cross the pod, picking up this data. The student can receive educational programs broadcast from a campus of Universal University, or access educational programs through CD-

ROMs or Zip type disks or whatever other form of data delivery systems are developed by now.

The pod provides a facility in which the student is placed in virtual reality environments, and in which the student can interact physically and vocally with people and experiences in those virtual reality environments based upon specific pedagogic goals. Students can also link their pods with other students' pods, so they can work on projects individually, in dyads, or in small and large groups. Mass lectures can even take place if that educational environment is needed.

As an example, a student is enrolled in my Nonverbal Communication course. I have designed a unit that focuses on the topic of eye contact in nonverbal and interpersonal contexts. The first part of the program introduces the student to information and content on the topic of eye content, including definitions, studies, applications, etc. The student can then move onto a menu of virtual reality programs that will allow her or him to explore further the use of eye contact in interpersonal relationships. For instance, one virtual reality program places the student in the world depicted in Margaret Atwood's novel A Handmaid's Tale. The student, whether male or female, finds him or her self in the costume of a Handmaid, wearing the headgear that is designed to limit eye contact, and the student will be able to experience the effect of this limited eye contact on interpersonal communication. Another virtual reality program might place the student in the world Hunter Thompson describes in his ethnographic study Hell's Angels. Here the student finds her or himself in a bar with a group of Hell's Angels and eye contact with them might mean a good stomping.

This scenario is far removed from the process of education as it now takes place, but we have to wonder what the future holds for education, particularly in light of financial exigencies and technological developments that are still to come. We have to be prepared to make significant changes in how we define the process of teaching our students, and how we define our jobs and roles as educators. The twentieth century brought significant changes in how we live, work and play, and the twenty-first century is likely to bring even more drastic changes. I hope that we are on the verge of a major revolution, a major paradigm shift, in how we view education, and in how we go about that process. I really doubt that I will live to see 2054, but I am pretty sure that I will get pretty close to it, and I hope I see some exciting and challenging changes in how we teach in the next twenty or thirty years.

Conclusion

It seems that at this point in its development, virtual reality is better suited, or more useful, to some academic disciplines than others. For instance, current applications for virtual reality programs in the natural sciences seem clear and abundant. Chemistry, anatomy, biology, and physics, for instance, all offer many opportunities to teach lessons using virtual reality, particularly through 2D and 3D modeling programs. It has also been frequently cited in this essay that the lessons of one of the social and behavioral sciences, archeology, can be already be learned through virtual reality programs. And, it seems appropriate to state that other social and behavioral sciences, such as geography and history, lend themselves well to the prospect of using virtual reality, as we have seen it used in archeology. In the humanities and fine arts, there are also many disciplines that might find virtual reality very useful in the near future in teaching students their lessons: literature, modern languages, philosophy and theatre, to name a few.

Sanders notes several possibilities for the future of virtual reality in education. He predicts: 1) multi-user virtual worlds that feature virtual actors that move, look and act like real people; 2) completely interactive on-line knowledge bases accessible from within virtual worlds (Sanders and Gay, 1997); 3) remote conferences held in virtual environments; and 4) the use of projection holography in education. Sanders further proposes that in the near future: "interactive, networked, multi-user, virtual reality based education will enhance student learning by: 1) offering vicarious firsthand experiences otherwise beyond the reach of students or the school administrations; 2) providing interaction with geographically or temporally remote locations, people or objects; and 3) providing information at levels of detail tailored to individual student needs.

The use of virtual reality technology in the Communication discipline is a challenge that we should investigate thoroughly, and that we should begin to embrace as we move into the twenty-first century. Learning will no longer be bound to specific times or places. Students and teachers will be able to access knowledge, information and experiences that were unattainable before. But, this will also require us to reexamine and redefine ourselves as educators, and to bring changes to the way we have done things as a discipline in the past. That sort of challenge is never an easy one to face, and many people would prefer to live in the past than to move into the future. I hope that the new millennium will see us embrace these changes, and continue to move forward as a discipline. The possibilities are limitless.

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